

REMARKS

Upon entry of the present amendment, claims 1-8 will be amended, and claim 9 will be added, whereby claims 1-9 will be pending.

By the amendment herein, independent claims 1 and 4 have been amended to even more explicitly recite Applicants' subject matter. Moreover, the dependent claims have been amended to remove subject matter in parenthesis, and to include at least one language when reciting multiple components so that it is explicitly recited that the subject matter includes any of the individual components as well as combinations thereof. Moreover, claims 3 and 7 have been amended to recited NiCl_2 . Support for the amendment to the claims appears throughout Applicants' originally filed specification including page 4, paragraph [0013], page 9, paragraph [0022] and page 21, paragraph [0043].

Any amendments to the claims which have been made in this amendment should be considered to have been made for a purpose unrelated to patentability, and no estoppel should be deemed to attach thereto.

Reconsideration of the rejections of record, and allowance of the application in view of the following remarks are respectfully requested.

Information Disclosure Statements

Applicants express appreciation for the Examiner's confirmation of consideration of Applicants' Information Disclosure Statements filed, August 3, 2006, and May 30, 2007 and July 2, 2008 by including initialed copies the Forms PTO-1449 submitted therewith with the Office Action.

Applicants have submitted a Third Supplemental Information Disclosure Statement on June 30, 2009, and the Examiner is requested to initial the Form PTO-1449 submitted with the Third Supplemental Information Disclosure Statement, and to include an initialed copy with the next communication from the Patent and Trademark Office.

Authorization is hereby provided to charge any fee necessary for consideration of the Information Disclosure Statement to Deposit Account No. 19-0089.

Objections to the Claims

Claims 1-8 are objected to for several matters discussed on pages 2 and 3 of the Office Action.

Claims 1 and 4 are objected to for using the term “steam” instead of “vapor”. In response, “steam” has been amended to “vapor” so that this ground of objection should be withdrawn.

Claim 4 is objected to for containing a parenthetical phrase. In response, claim 4 as well as claims 3-and 5-8 have been amended to delete parenthetical expressions. Accordingly, this ground of objection should be withdrawn.

Claims 3 and 7 are objected to as the objection asserts that it is not clear whether metal chloride is cupric chloride only, or ferric chloride only, or both, or all of the three. In response and as discussed above, , Applicants have amended the claims to include at least one language when reciting multiple components so that it is explicitly recited that the subject matter includes any of the individual components as well as combinations thereof. Accordingly, this ground of objection should be withdrawn.

Response To Rejection Under 35 U.S.C. 112, Second Paragraph

Claims 1-8 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite.

The rejection contends that, in claims 1 and 4, the terminology “super-micro” powder is vague and indefinite, because it is not clear what size powder resides in the term “super-micro”. The rejection contends that any size particle in the prior art can be read on such terminology.

Regarding the terminology “super-micro”, Applicants submit that one having ordinary skill in the art would readily understand the metes and bounds of the claims, so that the claims are definite. For example, the Examiner’s attention is directed to page 1, paragraph [0002] of Applicants’ specification wherein super-micro particles having a particle size of not more than 0.4 μm are disclosed. Certainly, one having ordinary skill in the art would understand the meaning of super-micro powder following such description in Applicants’ specification.

Regarding claim 2, the rejection asserts that the valence recited therein is not clear. In response, claim 2 has been amended to more explicitly recite the claimed subject matter.

Accordingly, the 35 U.S.C. 112, second paragraph, indefiniteness rejections should be withdrawn.

Response To Art Based Rejections

The following rejections are set forth in the Office Action.

- (a) Claims 1 and 2 are rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 2,642,356 (hereinafter “US ‘356”) or U.S. Patent No. 2,642,357 (hereinafter “US ‘357”).
- (b) Claims 4-6 and 8 are rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 2,754,193 (hereinafter “US ‘193”) or U.S. Patent No. 2,754,195 (hereinafter “US ‘195”).
- (c) Claims 1 and 3 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,432,161 (hereinafter “US ‘161”) to Oda.
- (d) Claim 1-3 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 4,810,285 (hereinafter “US ‘285”) to Otsuka in view of Richardson (H.W. Richardson, “Copper Compounds”, in Ullmann’s Encyclopedia of industrial Chemistry, Wiley-VCH Verlag, June 15, 2000, pp. 1-13 and U.S. Patent No. 2,754,193.

(a) Claims 1 and 2 are not properly rejected as being anticipated by US ‘356 and US ‘357

Applicants submit that neither of US’ 356 nor US ‘357 teaches each and every feature recited in claims 1 and 2 so that the rejections should be withdrawn.

Applicants’ independent claim 1 is directed to a method of producing super-micro powder of a pure metal comprising heating a starting material forming metal chloride vapor, the starting material containing metal chloride and elemental metal of the metal contained in the metal chloride, and reducing the metal chloride vapor with hydrogen gas to produce the super-micro powder of a pure metal. Therefore, amongst the features

recited in independent claim 1, and further patentably defined in claim 2, the metal chloride and an elemental metal of the metal chloride are used as a starting material, and the starting material is heated to make the metal chloride and the elemental metal react for generating the metal chloride vapor which is reduced by hydrogen gas.

The rejection contends that US '356 describes the same subject matter; however, US '356 discloses a technique relating to a low temperature reducing method of a Ni-chloride, pure metal Ni added in a raw material is added as a reaction initiating catalyst for initiating the above reducing reaction at a low temperature in case of reducing NiCl_2 to obtain fine powder of Ni, and is not added as raw material for producing fine powder by forming lower metal chloride vapor as in the present invention.

Thus, the present method is directed to a vapor phase chemical reaction method for reducing vapor generated by heating a starting material containing metal chloride and elemental metal of the metal chloride. In such a method the formed metal chloride can have a lower valence than the starting material metal chloride, as seen, for example, paragraph [0023] on page 9 of Applicants' specification. In contrast, US '356 is directed to a low temperature method of directly reducing NiCl_2 , and not the reduction in the vapor phase. It is seen that US '356 does not discloses a vapor phase chemical reaction method, because the fine powder obtained by reduction should be formed at a place different from a position where the raw material is placed. See, for example, the top of page 6 of Applicants' specification wherein the heated metal chloride is evaporated with the rise of temperature and transported to the reduction part 3. However, in the producing method of US '356, as apparent from Example 1, the formed reduction Ni is existent as it is on the raw material charged boat. This means that the NiCl_2 in US '356 is reduced without changing into vapor.

Thus, US '356 does not disclose a method of producing super-micro powder of a pure metal comprising heating a starting material forming metal chloride vapor, the starting material containing metal chloride and elemental metal of the metal contained in the metal chloride, and reducing the metal chloride vapor with hydrogen gas to produce the super-micro powder of a pure metal.

For similar reasons, US '357 also does not teach each and every feature recited in Applicants' claims.

Accordingly, for at least the reasons set forth above, the anticipation rejection is without appropriate basis and should be withdrawn,

(b) Claims 4-6 and 8 are not properly rejected as being anticipated by US '193 or US '195".

Applicants submit that neither of US '193 nor US '195 teaches each and every feature recited in claims 4-6 and 8 so that the rejections should be withdrawn.

Applicants' independent claim 4 is directed to a method of producing super-micro powder of an alloy comprising heating a starting material forming metal chloride vapor, the starting material containing metal chloride and elemental metal as alloying components; and reducing the metal chloride vapor with hydrogen gas to form the super-micro powder of an alloy. Therefore, amongst the features recited in independent claim 4, and further patentably defined in dependent claims 5-6 and 8, metal chloride and elemental metal are used as a starting material, and the starting material is heated to make the metal chloride and the elemental metal react for generating the metal chloride vapor which is reduced by hydrogen gas.

The rejection contends that US '193 discloses the same subject matter as that recited in Applicants' claim 4. However, US '193 discloses the reduction of CuCl₂ only with the use of raw material prepared by mixing Fe powder in CuCl₂ and obtaining a mixed material of Cu powder and Fe powder, which is clearly different from the subject matter recited in independent claim 4 and the claims dependent therefrom. Claim 4 relates to producing super-micro powder alloy wherein a vapor phase chemical reaction method is used for obtaining super-micro powder of alloy by heating a metal chloride and reducing the generated metal chloride vapor with hydrogen gas. Therefore, as discussed above, a raw material charging place would differ from the place for obtaining a reduced product in such a vapor phase chemical reaction.

In contrast, the method of producing Cu-Fe powder of US '193 is, as described in Example 1, that raw material powder of CuCl₂ and Fe mixed at a predetermined rate is spread on a tray, placed in a muffle furnace, heated, and reduced by hydrogen gas being flowed on the tray. The product is obtained under the semi-sintered state on the tray where a raw material is charged. This indicates that in the producing method of US '193, a raw material of CuCl₂ and mixed Fe powder do not become vapor, that is, CuCl₂ is only directly reduced on the tray.

Further, regarding the product obtained by the producing method of US '193, the alloy does not become vapor of a metal chloride to be mixed and reduced and therefore cannot be considered as vapor of (Cu-Fe) alloy, but is simply a mixture of Cu powder formed by reducing and Fe powder added in raw material.

For similar reasons, US '195 also does not teach each and every feature recited in Applicants' claims.

Accordingly, for at least the reasons set forth above, the anticipation rejection is without appropriate basis and should be withdrawn,

(c) Claims 1 and 2 are not properly rejected as being obvious over U.S.

Patent No. 6,432,161 to Oda.

The rejection contends that claims 1 and 2 are obvious over Oda. However, as discussed above, Applicants' independent claim 1 is directed to a method of producing super-micro powder of a pure metal comprising heating a starting material forming metal chloride vapor, the starting material containing metal chloride and elemental metal of the metal contained in the metal chloride, and reducing the metal chloride vapor with hydrogen gas to produce the super-micro powder of a pure metal. Therefore, amongst the features recited in independent claim 1, and further patentably defined in claim 2, the metal chloride and an elemental metal of the metal chloride are used as a starting material, and the starting material is heated to make the metal chloride and the elemental metal react for generating the metal chloride vapor which is reduced by hydrogen gas.

To the contrary, as is understood from his Examples, Oda mainly aims at a liquid phase method, and only describes a method of obtaining powder by a vapor phase method in at column 6, lines 34-45.

Moreover, there is merely a description of the use of "volatile halide" as powder raw material, and there is no description nor suggestion about the use of a metal chloride and an elemental metal constituting the metal chloride.

Still further, the rejection refers to lines 5-20, col. 6 of Oda, and states that "the halide is preferably a subhalide, which may be produced, for example, by contacting niobium pentachloride gas with niobium metal at a high temperature of 500°C or more."

However, this description relates to a halide used in a method of producing metal powder by a liquid phase method, but does not relate to a halide used in a vapor phase method. This is clear from the description at column 5, line 66 to column 6, line 5 which is just above the description referenced in the rejection.

Therefore, the claimed subject matter is not rendered obvious over Oda, and the obviousness rejection should be withdrawn.

(d) Claims 1-3 and 7 are not properly rejected as being obvious in view of Otsuka, Richardson and US '193.

Applicants submit that one having ordinary skill in the art would not have combined the disclosures of Otsuka, Richardson and US '193, and that any combination thereof (assuming for the sake of argument that they can be combined) would not have arrived at Applicants' recited subject matter.

As noted above, Applicants' independent claim 1 is directed to a method of producing super-micro powder of a pure metal comprising heating a starting material forming metal chloride vapor, the starting material containing metal chloride and elemental metal of the metal contained in the metal chloride, and reducing the metal chloride vapor with hydrogen gas to produce the super-micro powder of a pure metal. Therefore, amongst the features recited in independent claim 1, and further patentably defined in dependent claims 2, 3 and 7, the metal chloride and an elemental metal of the metal chloride are used as a starting material, and the starting material is heated to make the metal chloride and the elemental metal react for generating the metal chloride vapor which is reduced by hydrogen gas.

A process for obtaining Cu super-micro powder with the use of CuCl₂ as a raw material is simply shown as follows.

Heating (CuCl₂ + Cu) → vapor of CuCl + H₂ → Cu powder.

As compared with this, Otsuka discloses a method of obtaining Cu fine powder by reducing CuCl with H₂ by a vapor phase chemical reduction method. However, the Otsuka method merely discloses the right half reaction of the above process. Otsuka does not disclose heating a starting material forming metal chloride vapor, the starting material containing metal chloride and elemental metal of the metal contained in the metal chloride.

Further, the Otsuka method is a vapor phase chemical reaction of a conventional technique described in the paragraph [0005] of the present specification, and has a problem of high raw material cost because of using material having a small valence, and therefore does not teach or suggest the subject matter recited in Applicants' claims 2, 3 and 7.

Regarding US '193, as discussed above, the method of producing Cu-Fe powder of US '193 is, as described in Example 1, that raw material powder of CuCl₂ and Fe mixed at a predetermined rate is spread on a tray, placed in a muffle furnace, heated, and reduced by hydrogen gas being flowed on the tray. The product is obtained under the semi-sintered state on the tray where a raw material is charged. This indicates that in the producing method of US '193, a raw material of CuCl₂ and mixed Fe powder do not become vapor, that is, CuCl₂ is only directly reduced on the tray.

Further, regarding the product obtained by the producing method of US '193, the alloy does not become vapor of a metal chloride to be mixed and reduced and therefore

cannot be considered as vapor of (Cu-Fe) alloy, but is simply a mixture of Cu powder formed by reducing and Fe powder added in raw material.

Accordingly, one having ordinary skill in the art would not have combined the disclosures of Otsuka and US '193 in view of their diverse disclosures. However, even if for the sake of argument the disclosures were combined, the claimed subject matter would not be present for at least the reason that neither Otsuka nor US '193 teaches or suggests that the metal chloride and an elemental metal of the metal chloride are used as a starting material, and the starting material is heated to make the metal chloride and the elemental metal react for generating the metal chloride vapor which is reduced by hydrogen gas. Applicants' process permits the obtaining of inexpensive powder of super-micro powder of a pure metal.

Regarding Richardson, Applicants submit that Richardson discloses a method of producing CuCl by reacting CuCl₂ and Cu. However, Richardson discloses, the technique relating to a producing method for obtaining CuCl under the fused state by reacting Cu and Cl₂ with the use of a shaft furnace, but does not disclose a technique of obtaining CuCl with the use of vapor phase chemical reacting. Therefore, Richardson merely describes a chemical reaction formula for producing CuCl and has no relation to the presently claimed subject matter.

There is no reason to combine Richardson with Otsuka and/or US '193. However, even if for the sake of argument the disclosures were combined, the claimed subject matter would not be present for at least the reason that none of Otsuka, US '193 and Richardson teaches or suggests that the metal chloride and an elemental metal of the metal chloride are used as a starting material, and the starting material is heated to make

the metal chloride and the elemental metal react for generating the metal chloride vapor which is reduced by hydrogen gas.

Accordingly, for at least the reasons set forth above, the rejections of record should be withdrawn.

CONCLUSION

In view of the foregoing, the Examiner is respectfully requested to reconsider and withdraw the objections and rejections of record, and allow each of the pending claims.

Applicants therefore respectfully request that an early indication of allowance of the application be indicated by the mailing of the Notices of Allowance and Allowability.

Should the Examiner have any questions regarding this application, the Examiner is invited to contact the undersigned at the below-listed telephone number.

Respectfully submitted,
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